New Tests Detect Growth Promoter in Livestock

Agricultural Research Service scientists in Fargo, North Dakota, have developed two new methods of detecting ractopamine hydrochloride, a feed additive given to pigs and cows so they'll produce leaner cuts of meat.

Use of the methods by livestock producers, meat inspectors, or export companies, for example, should provide greater flexibility in where, when, and how they measure ractopamine residues in animals. Such monitoring helps the U.S. meat industry safeguard against illicit use or accidental exposure. It also ensures good trade relations with the European Union, which disallows animal growth promoters like ractopamine and other beta-adrenergic agonists. So say Weilin Shelver, a chemist, and David Smith, an animal physiologist, in the Animal Metabolism-Agricultural Chemicals Research Unit of ARS's Red River Valley Agricultural Research Center in Fargo.

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Ractopamine, a feed additive promoting leaner meat, is approved by the Food and Drug Administration for use in pigs and cows but not yet in other animals. ARS scientists have developed two new methods of detecting the additive in meat.

Their first method is an ELISA (enzyme-linked immunosorbent assay), and the second is an optical biosensor. Both use a specialized type of protein called a monoclonal antibody. The scientists developed this antibody using modern biotechnology techniques.

Both methods are fast, easy to use, specific, and sensitive, and they give similar measurements, notes Shelver. "The major difference is in how they make the measurements," she adds. "An advantage of the biosensor is that it sometimes gives less interference, or background noise, from the other materials in the sample."

In the United States, ractopamine has been approved for use in pigs since 2001 and cattle since 2003. Ractopamine use leads to leaner, more efficient animals that reach their market weights sooner than untreated animals.

With such gains, however, is the potential for illicit use in animals—such as fish, goats, and sheep—for which ractopamine approval hasn't been granted by the U.S. Food and Drug Administration.

"Beta-adrenergic, leanness-enhancing agents have been used illegally at farms, livestock shows, horse-racing events, and even in humans for their purported performance- and profit-enhancing effects," notes Smith. "Either the ractopamine biosensor or ELISA assay could be used in these situations and would be especially useful when live animals need to be tested quickly."

High-performance liquid chromatography (HPLC) is the gold standard to measure beta-agonists like ractopamine. But it can be laborious, time consuming, and costly, notes Shelver.

In trials with urine samples from ractopamine-fed cows and sheep, the biosensor and ELISA test were equal to HPLC in detecting concentrations of 5 to 20 parts per billion, Shelver reports. ELISA is the fastest of the three, since it can analyze many samples simultaneously. The biosensor works best with fewer or sequential samples.

The biosensor works by taking readings of light reflected off the surface of a tiny gold chip. This happens after molecules of ractopamine fixed onto the chip are bathed in a urine sample containing both ractopamine and the monoclonal antibody. The antibody then binds to the chip, changing the angle of reflected light. The instrument detects this change, revealing how much ractopamine is in the sample. Similar studies are now under way in pigs.

ARS has patented the ractopamine monoclonal antibody to encourage its commercial development by industry.—By **Jan Suszkiw,** ARS.

This research is part of Food Safety (Animal and Plant Products), an ARS National Program (#108) described on the World Wide Web at www.nps.ars.usda.gov.

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